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Lam

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(54) **TRANSDUCER APPARATUS RESPONSIVE TO EXTERNAL PERTURBATION**

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(22) Filed: **Aug. 14, 1995**

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(51) **Int. Cl.**[7] **G10K 1/00**; B60Q 1/00

(52) **U.S. Cl.** **340/392.1**; 340/425.5; 340/429; 340/600; 340/693.1; 307/9.1; 40/424; 362/486

(58) **Field of Search** ..... 340/467, 464, 340/429, 683, 392, 689, 691–693, 665, 566, 392.1, 392.4, 392.5, 395.1, 425.5, 426, 473, 321, 546, 547, 471, 472; 200/61.45 R, 61.52, 52 A; 362/253, 806, 486; 84/404, 464 R; 40/409, 485, 591, 593, 594, 600, 621, 424; 307/9.1, 10.1

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,780,802	A	*	2/1957	Propos	340/321
3,192,517	A	*	6/1965	Werlin	340/546
4,833,454	A	*	5/1989	Pawlik et al.	340/693
4,841,288	A	*	6/1989	Addicks	340/693
4,842,235	A	*	6/1989	Brown et al.	248/452
4,926,573	A	*	5/1990	Hetrick	40/663
4,951,045	A	*	8/1990	Knapp et al.	340/691
5,252,947	A	*	10/1993	Marciano	340/692
5,266,920	A	*	11/1993	Langner	340/568
5,315,492	A	*	5/1994	Davenport	362/122
5,373,581	A	*	12/1994	Smith	392/390

FOREIGN PATENT DOCUMENTS

FR	2639299	*	5/1990	340/425.5

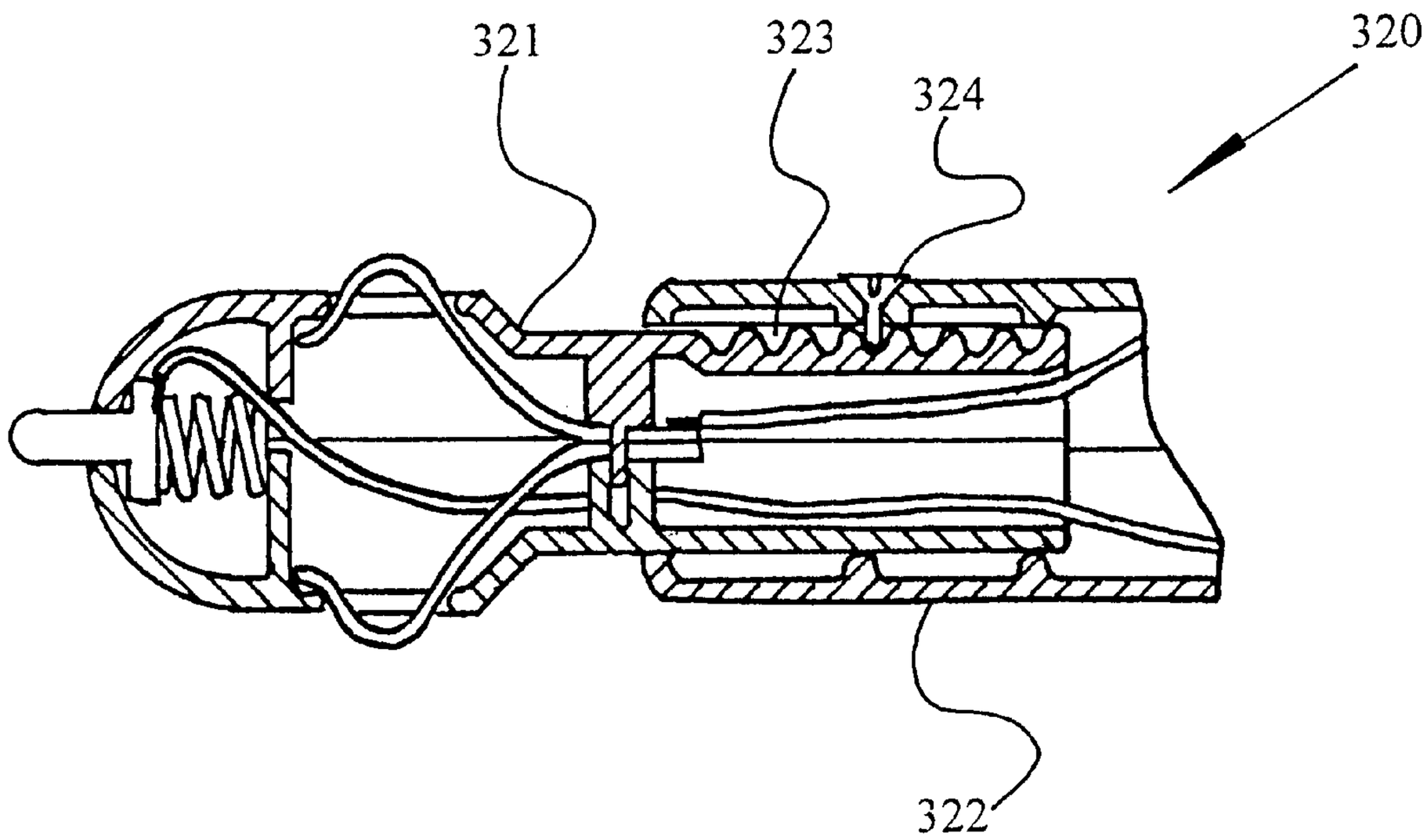
* cited by examiner

Primary Examiner—Donnie L. Crosland

(57) **ABSTRACT**

Transducer apparatus **(10)** responsive to external perturbations is disclosed having an electrically responsive transducer circuit **(12)** energized when a display member **(18)** and an elongate member **(20)** move from a gravity determined quiescent orientation **(20A)** therebetween to an external perturbation driven active orientation **(20B)** therebetween. In various embodiments, the members are respectively responsive to air movement and acceleration. In one embodiment, the elongate member carries a first electrical contact **(21)** to abut a second electrical contact **(22)** carried by the display member. When the apparatus is to be in use with a motor vehicle, the apparatus is desirable to be powered by the cigarette lighter of the vehicle and a light sensor is added to switch on the apparatus during night time.

8 Claims, 9 Drawing Sheets



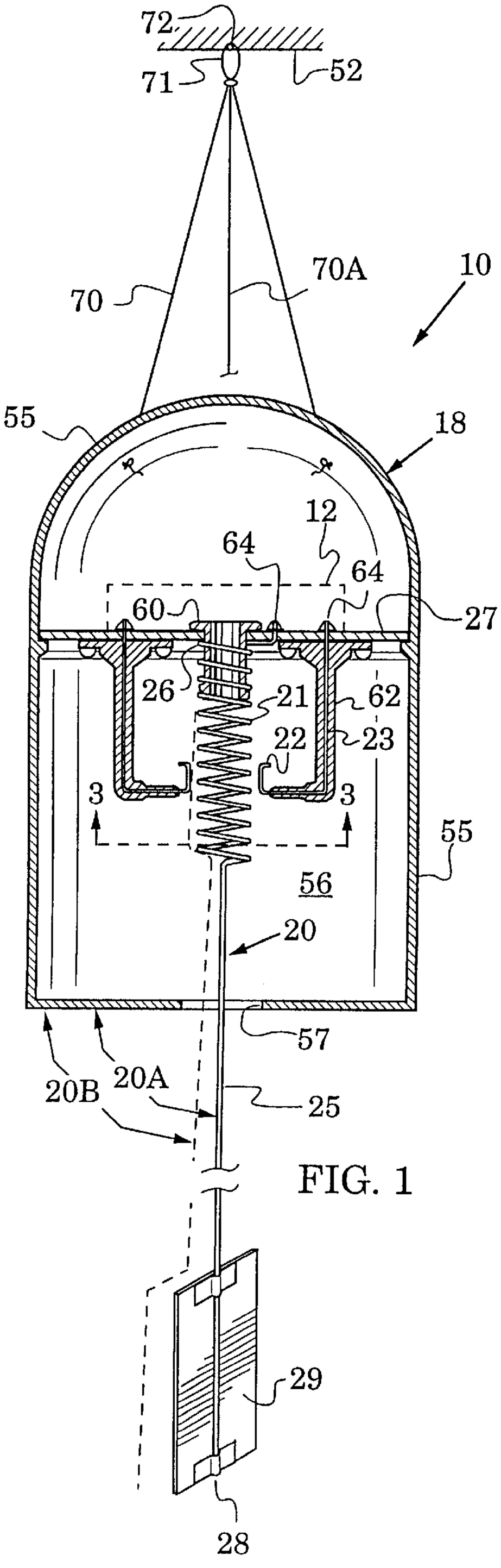

72
71
52
70
70A
10
55
18
12
64
64
60
27
26
21
62
22
23
3
3
55
56
20
57
20B
20A
25
29
28

FIG. 1

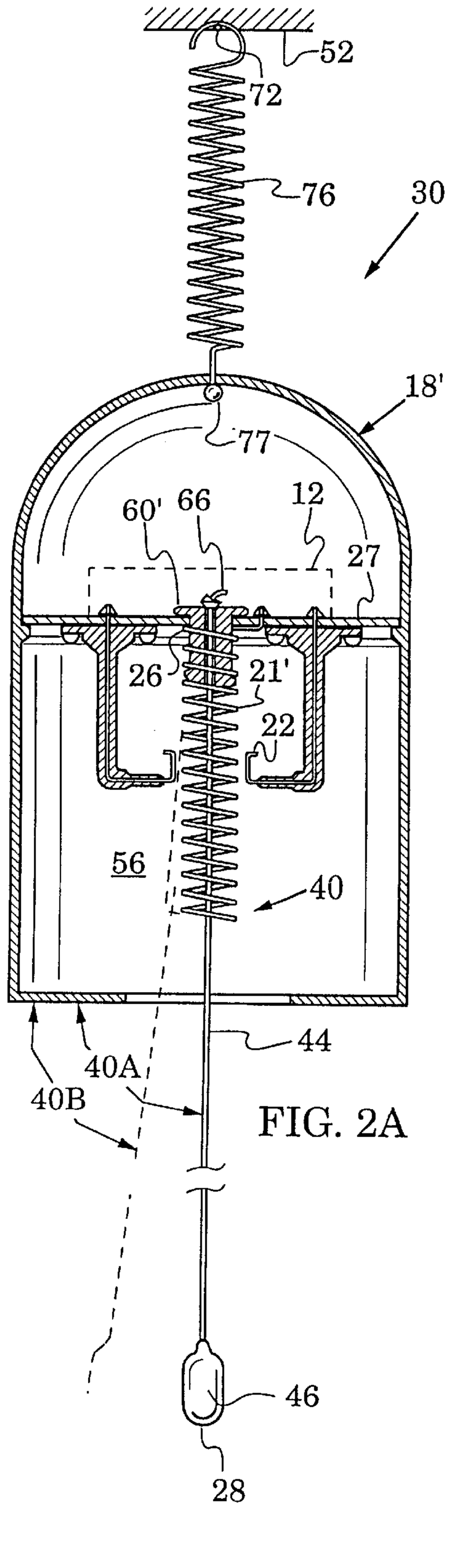

52
72
76
30
18'
77
60'
66
12
27
26
21'
22
56
40
44
40A
40B
46
28

FIG. 2A

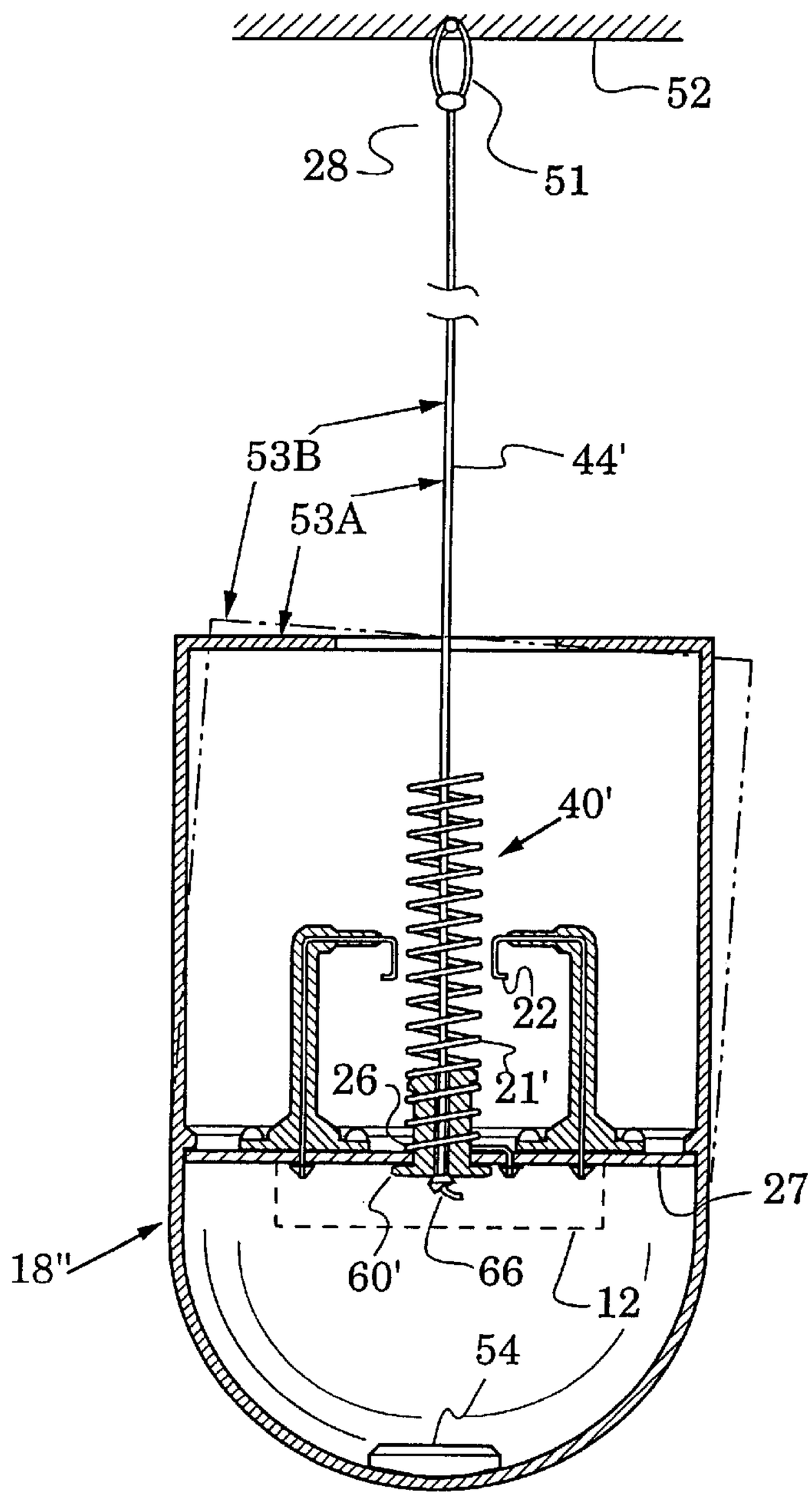


FIG. 2B

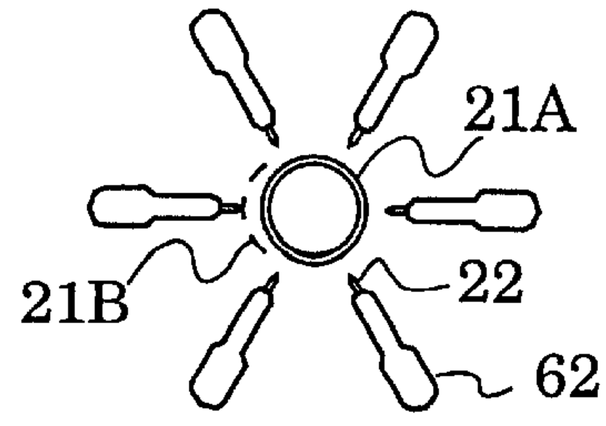


FIG. 3

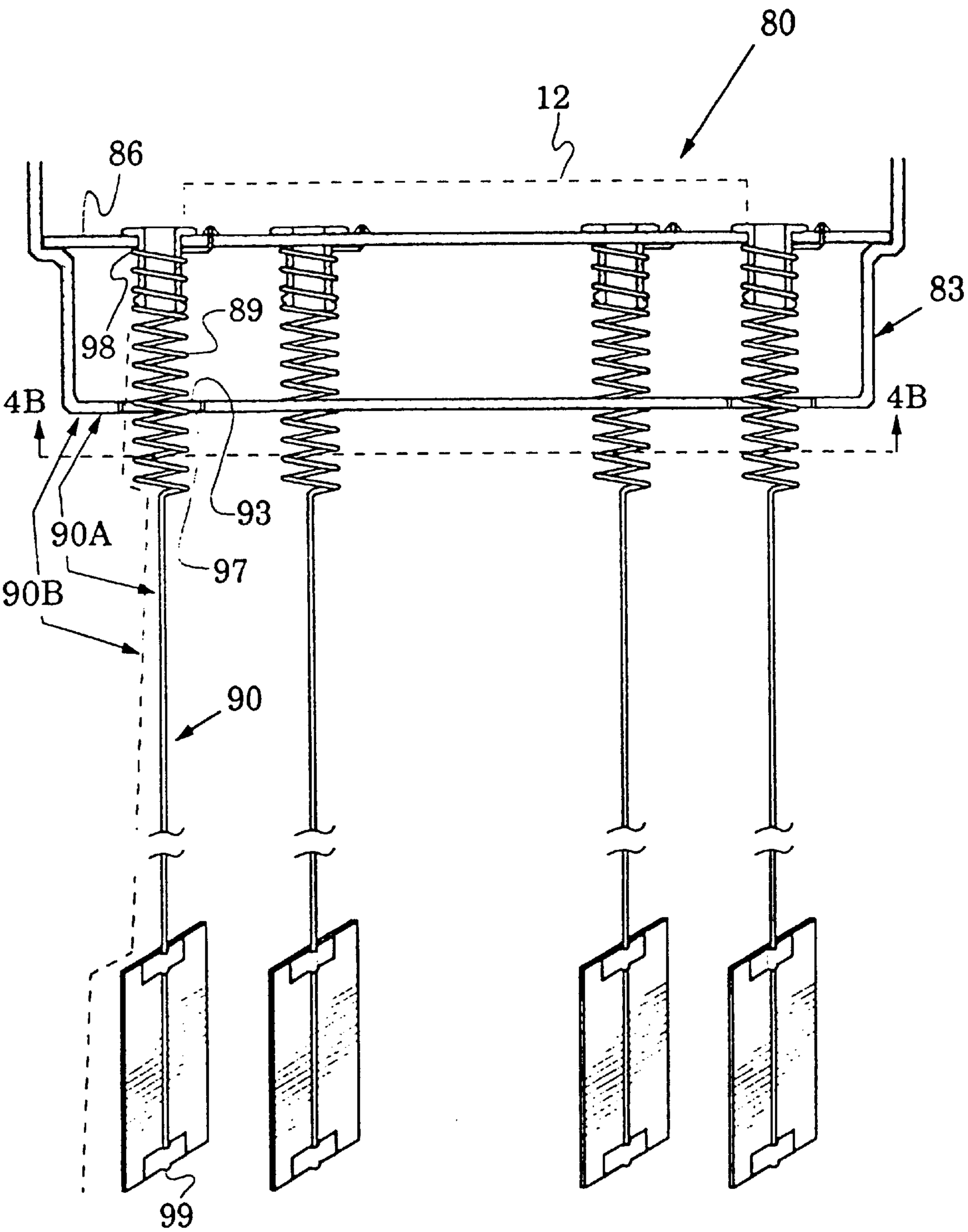


FIG. 4A

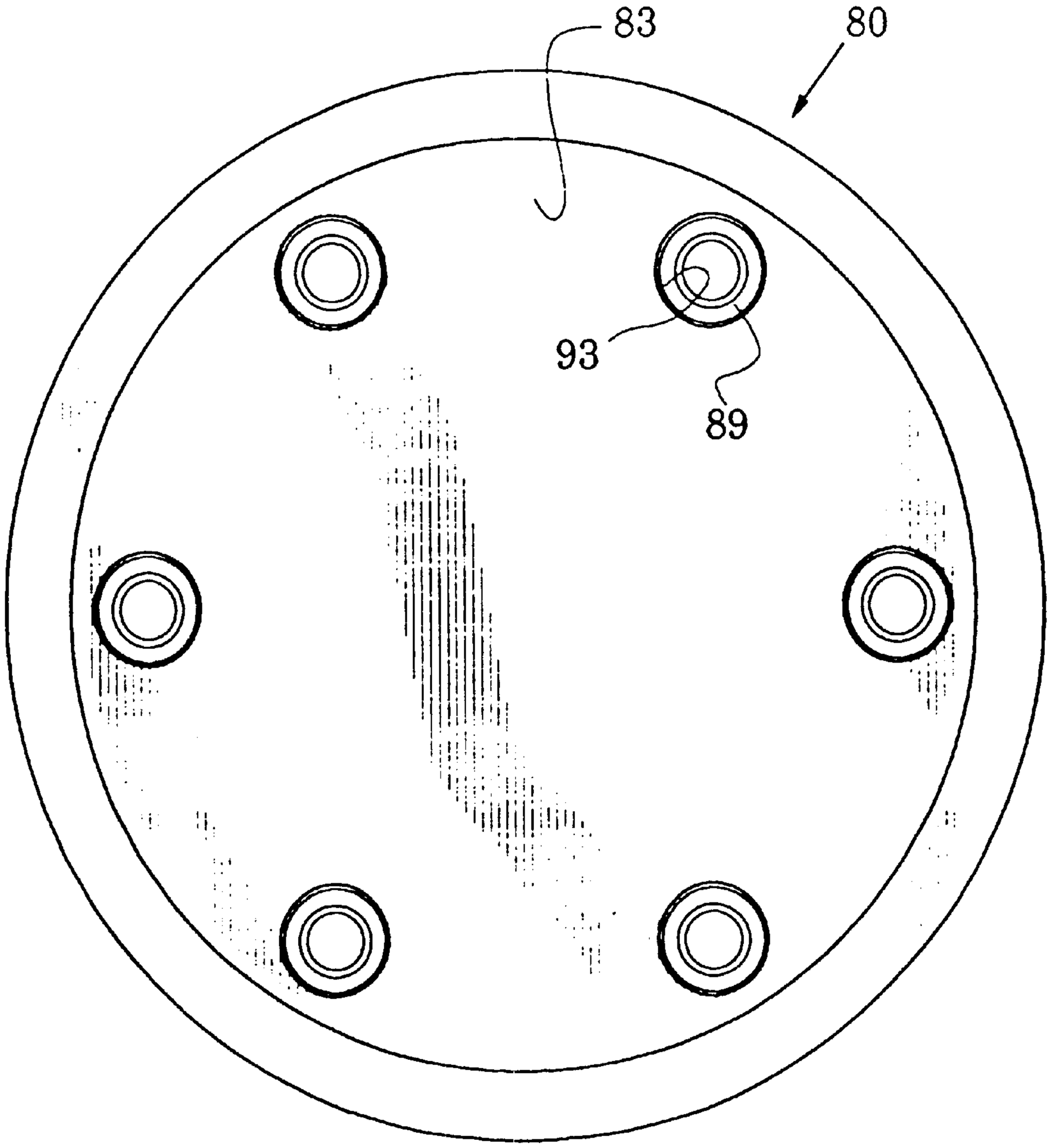


FIG. 4B

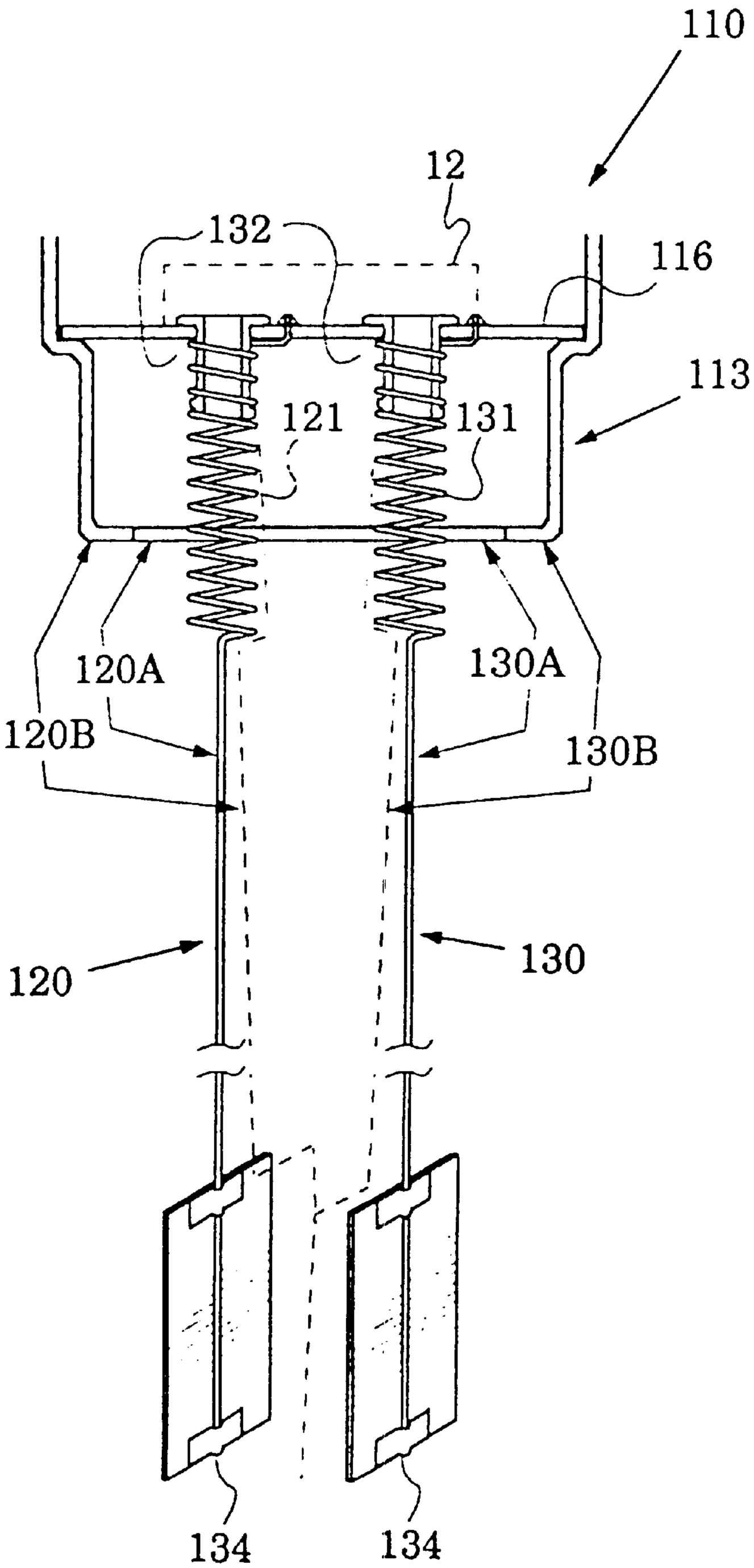


FIG. 5

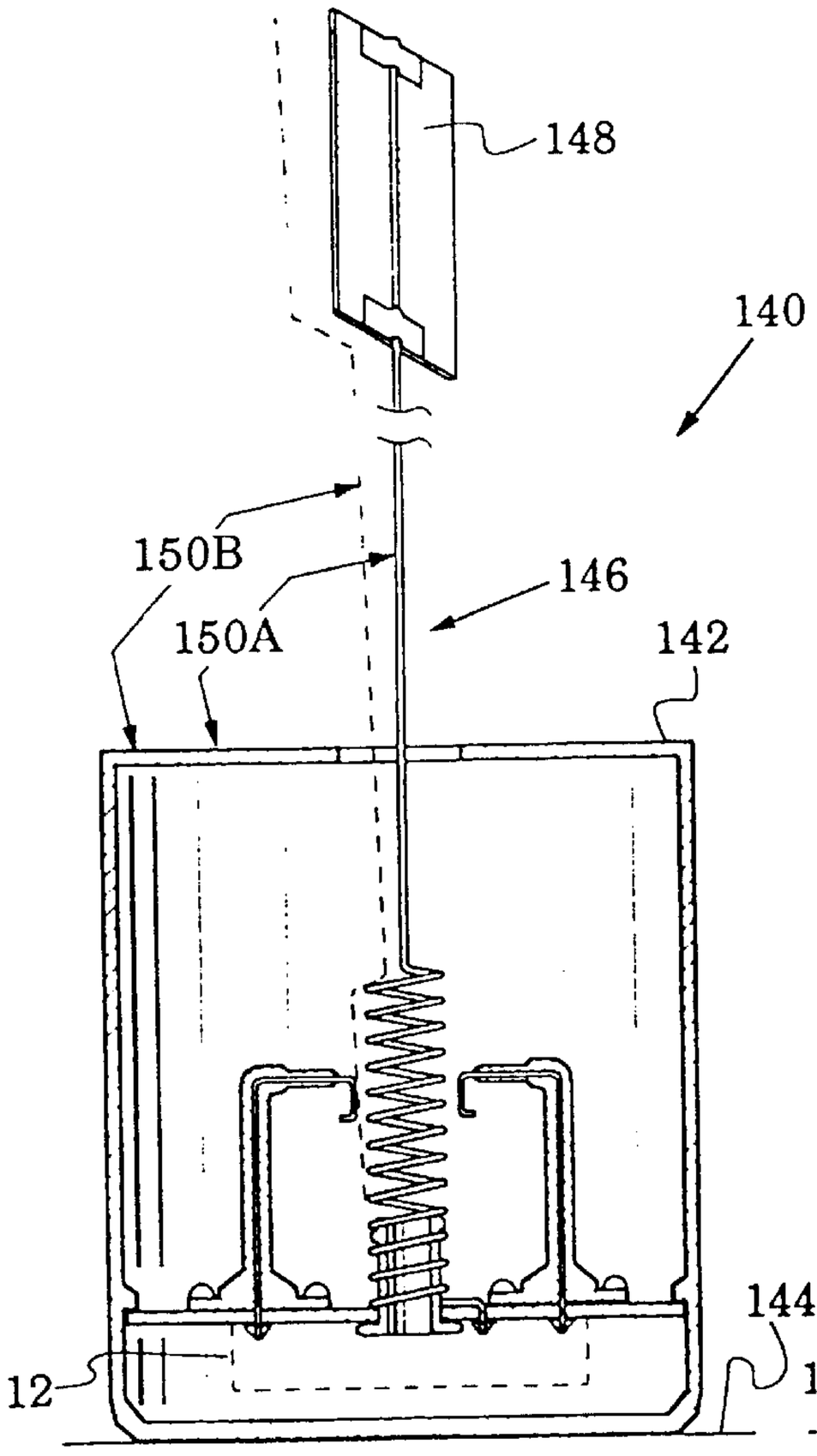

148
140
150B
146
150A
142
144
12

FIG. 6

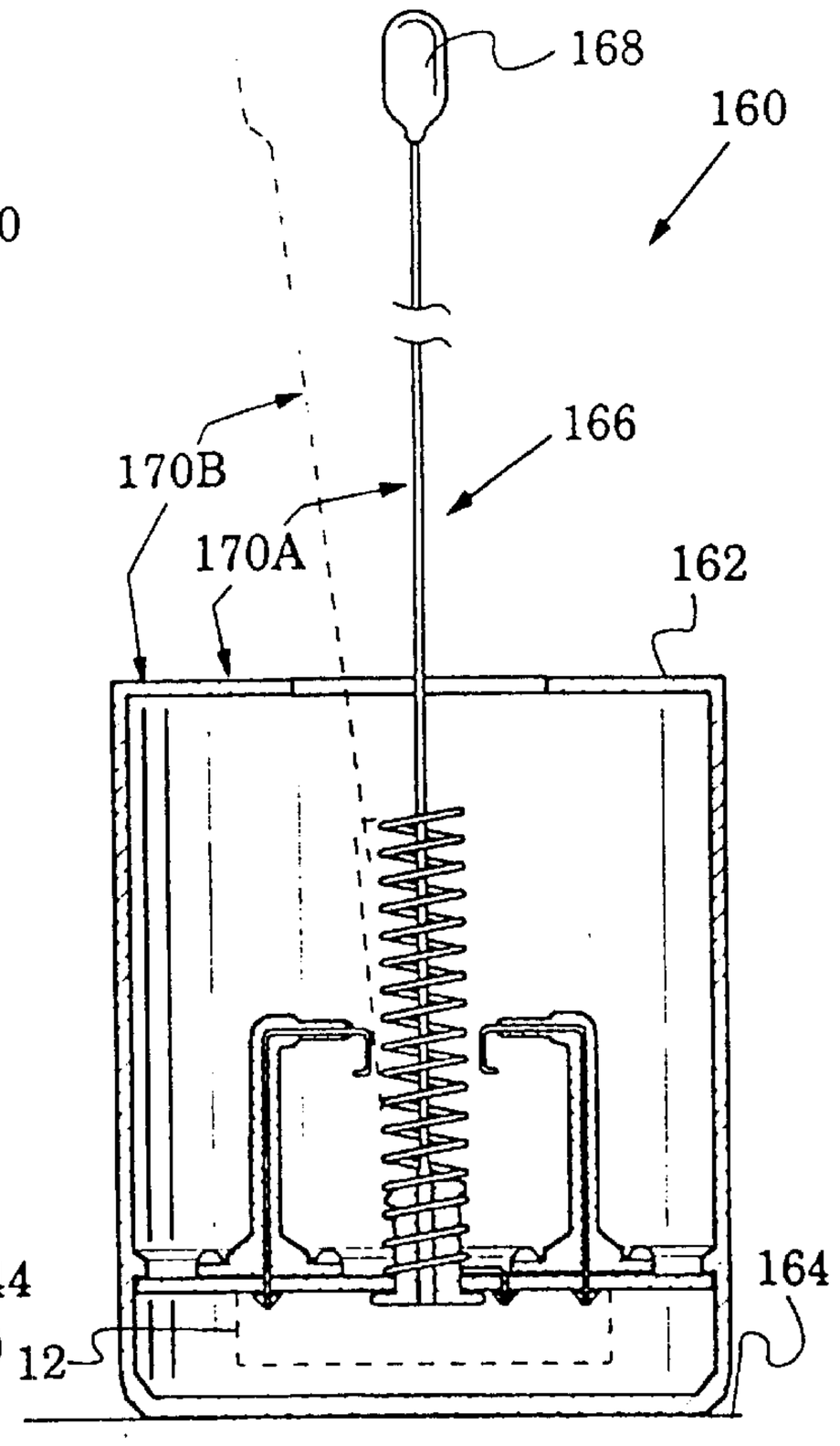

168
160
170B
166
170A
162
164
12

FIG. 7

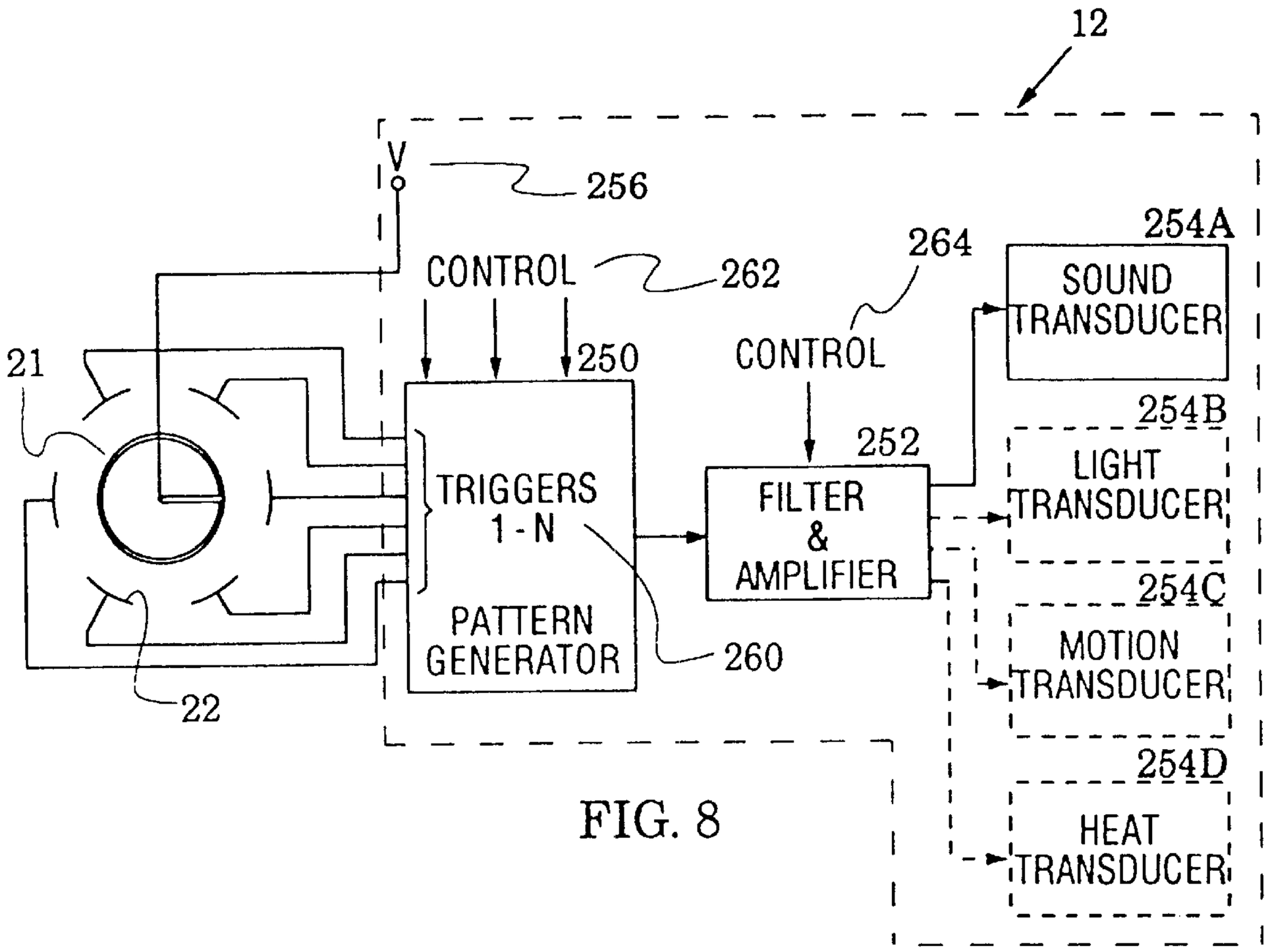
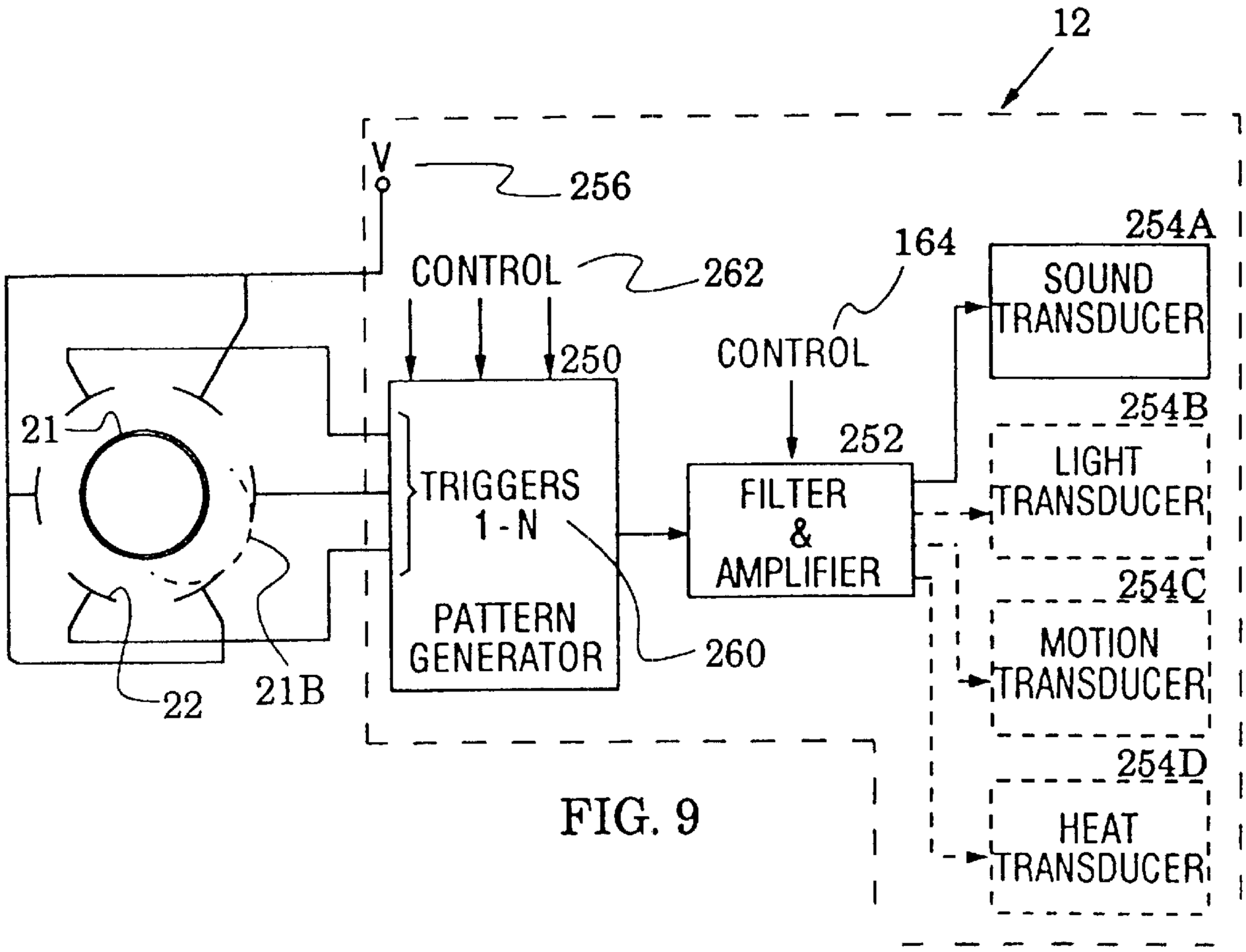

12
V
256
CONTROL
262
264
254A
SOUND TRANSDUCER
254B
LIGHT TRANSDUCER
254C
MOTION TRANSDUCER
254D
HEAT TRANSDUCER
21
250
CONTROL
252
TRIGGERS 1-N
FILTER & AMPLIFIER
PATTERN GENERATOR
260
22

FIG. 8


12
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CONTROL
262
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254A
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254B
LIGHT TRANSDUCER
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MOTION TRANSDUCER
254D
HEAT TRANSDUCER
21
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CONTROL
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TRIGGERS 1-N
FILTER & AMPLIFIER
PATTERN GENERATOR
260
22
21B

FIG. 9

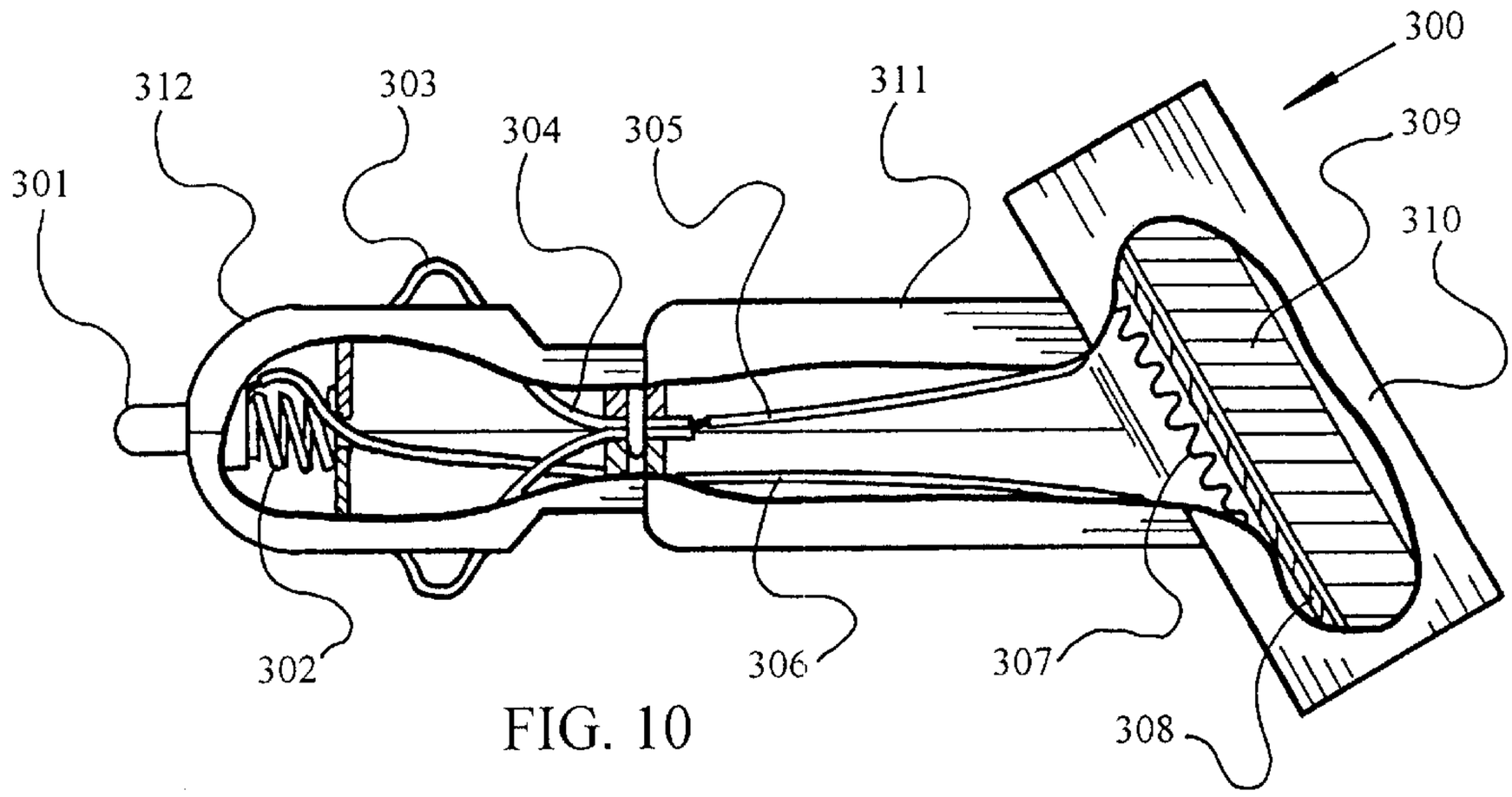

FIG. 10

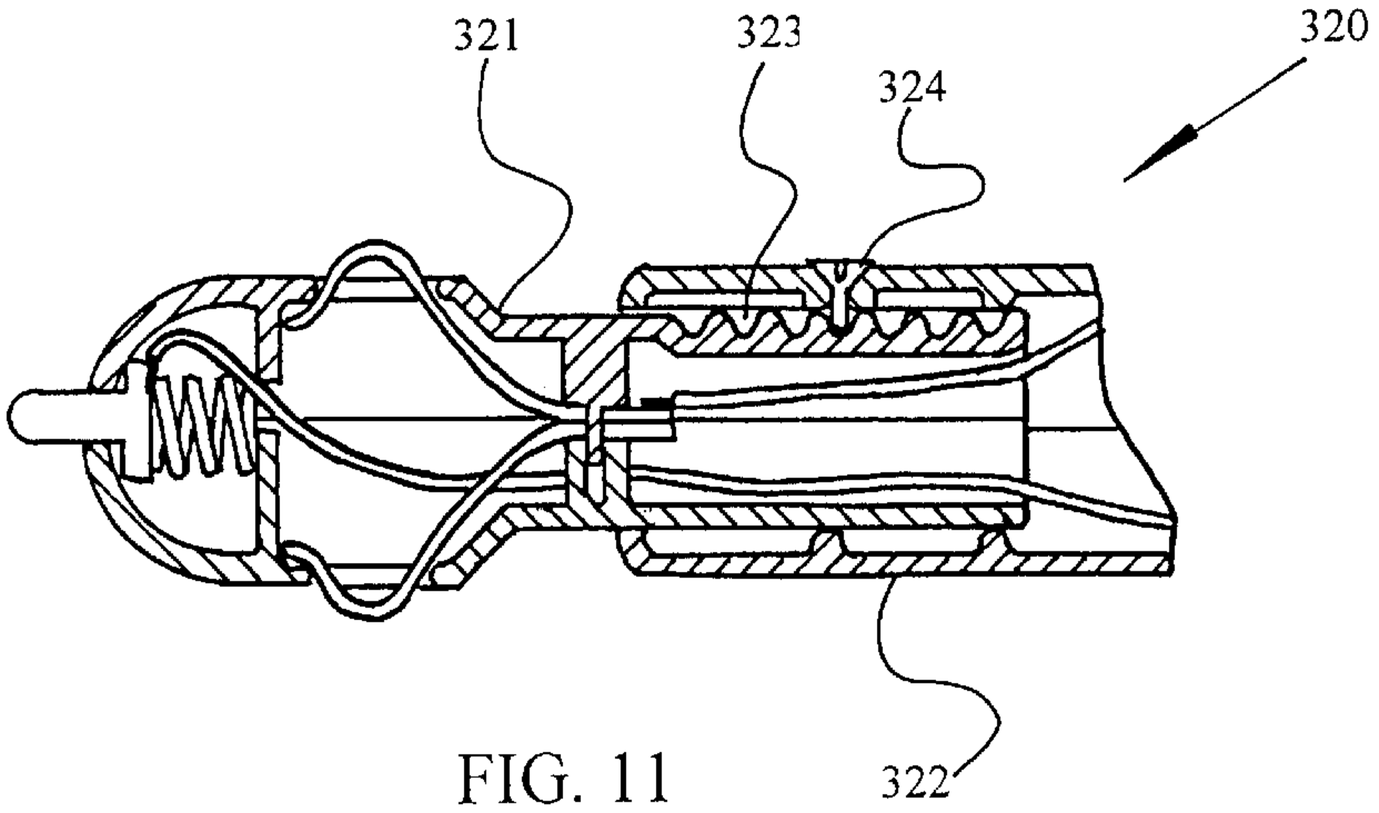

FIG. 11

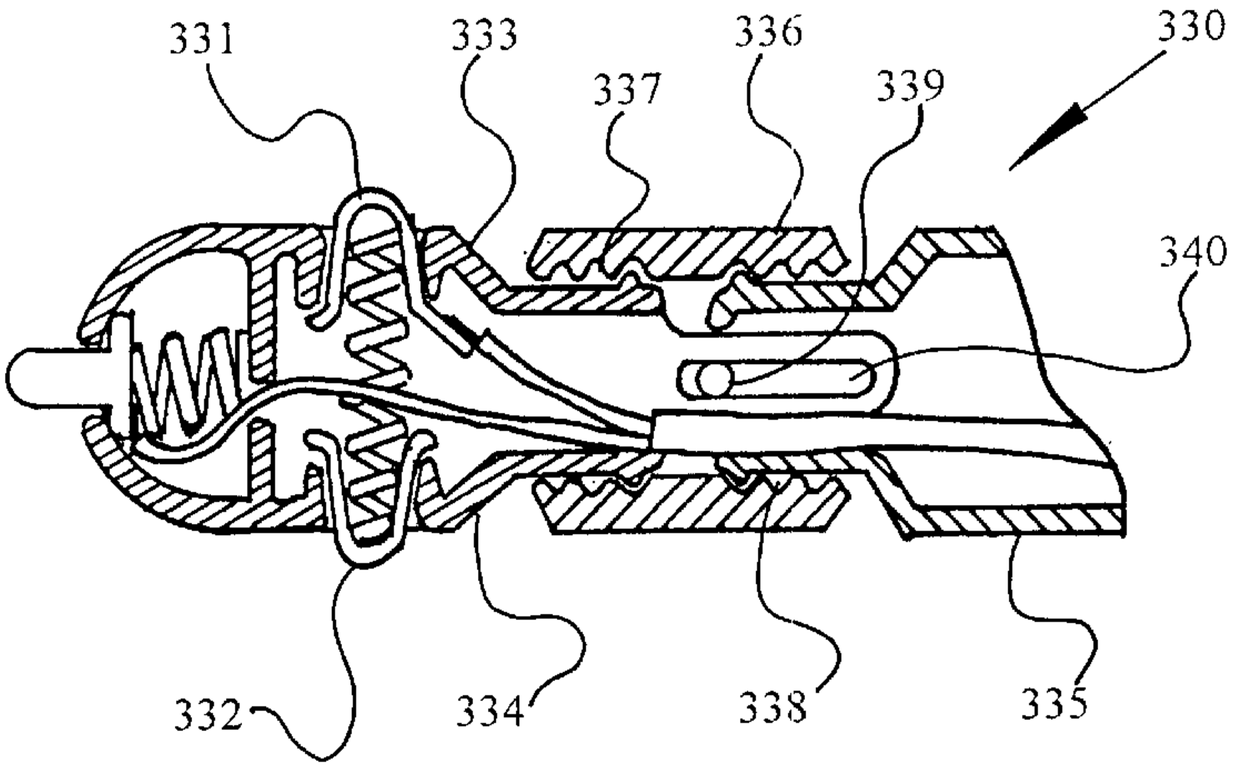

FIG. 12

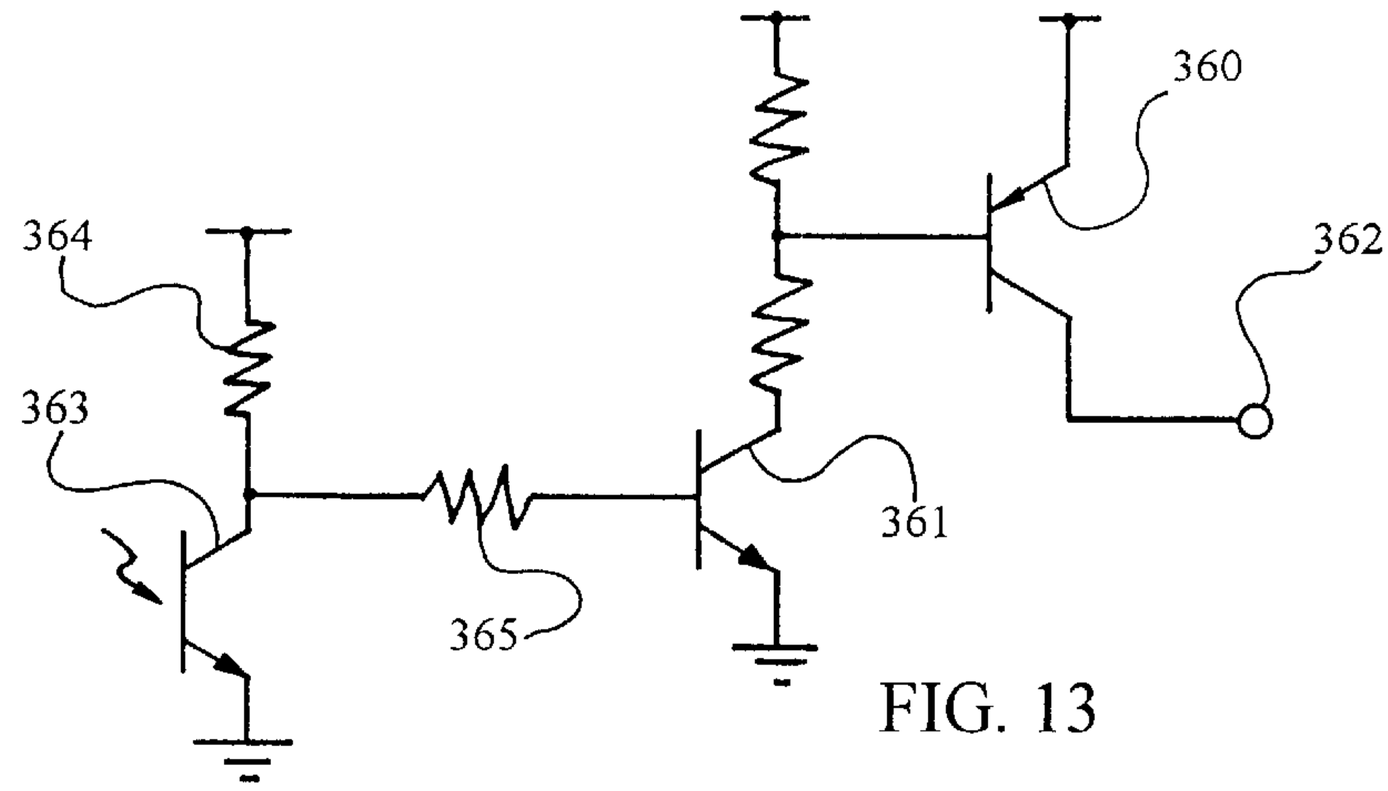

FIG. 13

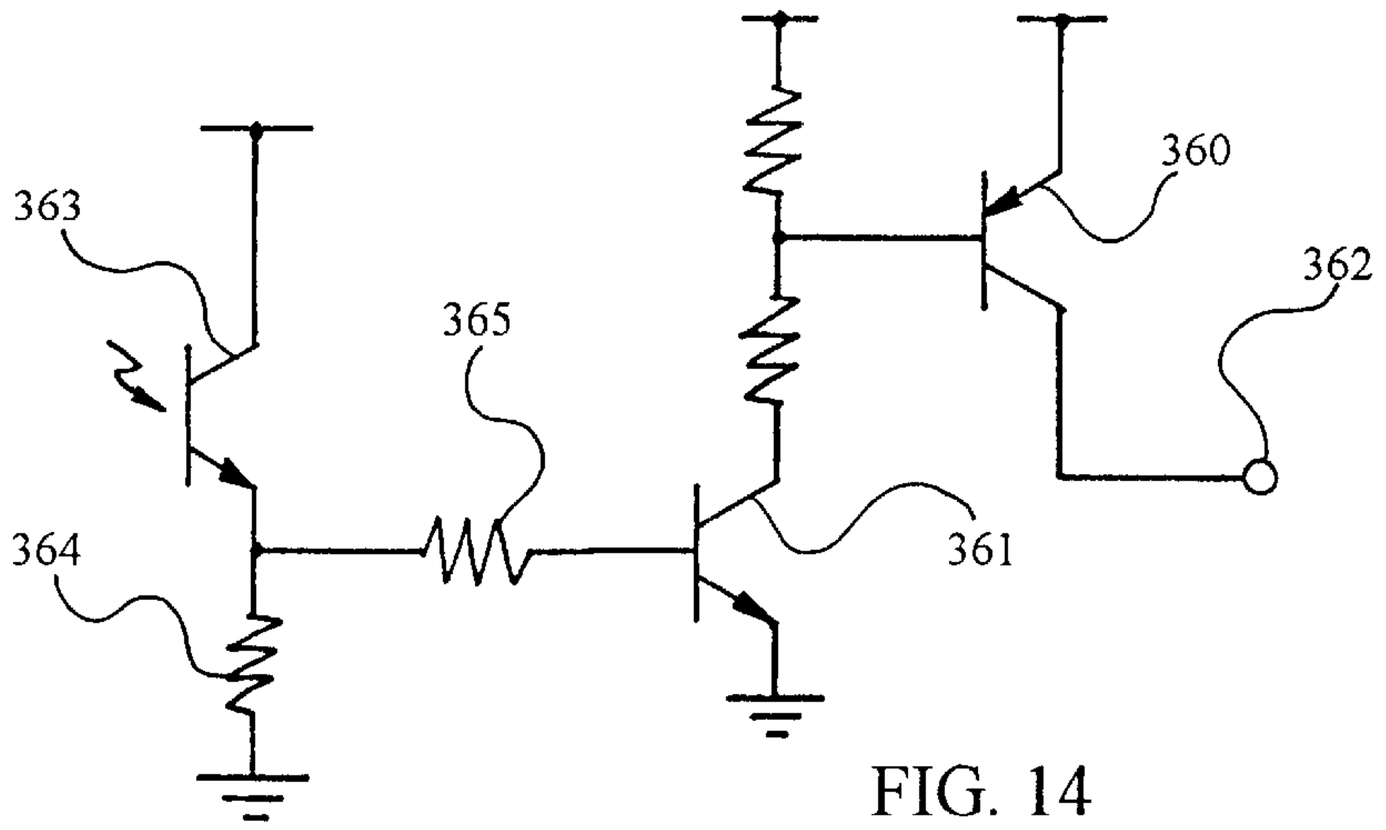

FIG. 14

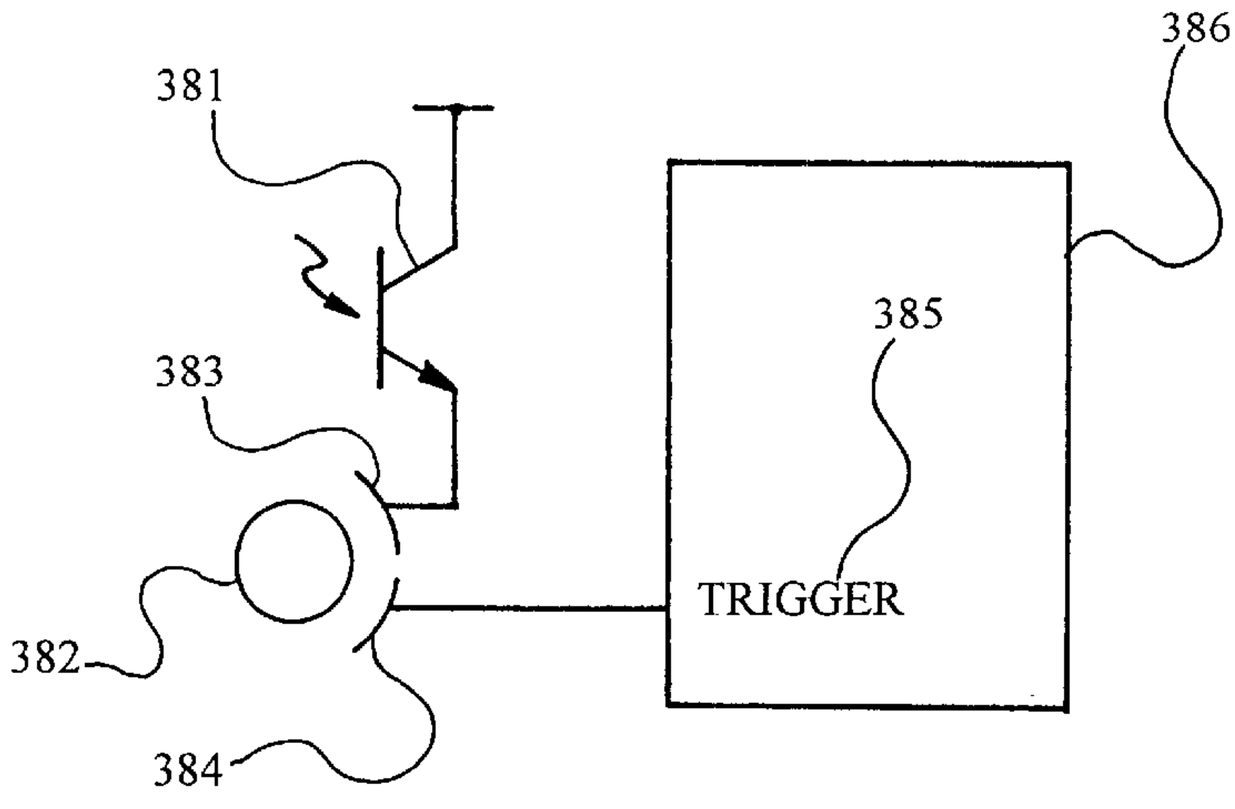

FIG. 15

TRANSDUCER APPARATUS RESPONSIVE TO EXTERNAL PERTURBATION

RELATED APPLICATIONS

This is a Continuation-in-part of U.S. application Ser. No. 07/999,291 filed Dec. 31, 1992, now U.S. Pat. No. 5,469,132, granted Aug. 14, 1995 and U.S. application Ser. No. 08/405,584 filed Mar. 17, 1995, now U.S. Pat. No. 5,473,307, granted Dec. 5, 1995, which are incorporated herein by reference.

FIELD OF THE INVENTION

The present invention relates to display apparatus for energizing an electrically responsive transducer in response to external perturbations, e.g., air movement and or acceleration, to produce an output comprised of sound and/or light and/or motion and/or heat.

BACKGROUND OF THE INVENTION

Traditional transducer apparatus derives power from a battery source and requires a on/off switch to control the power supplied to the apparatus. The objective of the invention is to develop an automobile display apparatus to derive power from the cigarette lighter and for the power of the display apparatus to be switched on and off according to the ambient light of the vehicle.

SUMMARY OF THE INVENTION

The present invention is directed to the power supply structure of an apparatus producing an electrically generated output, e.g., sound and/or light and/or motion and/or heat. The power supply of the apparatus is derived from battery or connected to the cigarette lighter socket of an automobile. A light sensitive component is installed to switch on or off the apparatus according to the optical signal picked up.

Embodiments of the invention are particularly suited for use, for example, display device in automobiles to produce lighting effects to enhance driving pleasure at night. The apparatus is switch on automatically when the car is in motion and when a predetermined darkness level is detected by the optical sensor. The power of the device is automatically switched off when the car is not in motion or in day time.

Additionally, embodiments of the invention find utility in many other applications, e.g., in wind chime, or refrigerator door display magnet to produce electronically simulated sounds or lighting effects. The decorating device is switched on only when the light sensor picks up qualifying optical signal such as when sufficient day light is detected.

Embodiments of the invention are characterized by a light sensitive component which pick up ambient light signal to control the activation of the apparatus. When the apparatus is for use in an automobile, the power supply is not only desirable to be switched on when low light level is detected but also to be derived from the 12V cigarette lighter socket. An adjustable rigid connecting plug is preferable to support the device and provide room for the electronics.

The novel features of the invention are set forth with particularly in the appended claims. The invention will be best understood from the following description when read in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a sectional elevation view of a first embodiment of the present invention;

FIG. **2**A is a sectional elevation view of another embodiment of the invention;

FIG. **2**B is a sectional elevation view of another embodiment of the invention;

FIG. **3** is a view along the plane **3**—**3** of FIG. **1**;

FIGS. **4**A and **4**B are sectional elevation views of another embodiment of the invention;

FIG. **5** is a sectional view of another embodiment of the invention;

FIG. **6** is a sectional elevation view of another embodiment of the invention;

FIG. **7** is a sectional elevation view of another embodiment of the invention;

FIG. **8** is a circuit diagram of an embodiment of the invention;

FIG. **9** is a circuit diagram of another embodiment of the invention;

FIG. **10** is a sectional elevation view of another embodiment of the invention;

FIG. **11** is a sectional elevation view of another embodiment of the invention;

FIG. **12** is a sectional elevation view of another embodiment of the invention;

FIG. **13** is a circuit diagram of another embodiment of the invention;

FIG. **14** is a circuit diagram of another embodiment of the invention; and

FIG. **15** is a circuit diagram of another embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A preferred embodiment **10**, in accordance with the present invention, of a transducer apparatus responsive to external perturbation is illustrated in the elevation view of FIG. **1**. The apparatus **10** includes an electrically responsive transducer circuit **12** (indicated by broken lines and illustrated in FIG. **8**) carried by a display member **18**. The transducer circuit **12** is energized by completion of an electrical path when an elongated member **20** swings, relative to the display member **18**, from a stable substantially vertical quiescent orientation **20**A to an unstable active orientation **20**B.

The completion of the electrical path due to the display member **18** and elongated member **20** changing to the activate orientation **20**B may be implemented in many different ways. For example, a proximity switch, an energy beam (e.g. visible or infrared light), or electrical contacts can be positioned to sense change between orientations **20**A, **20**B.

FIG. **1** illustrates an embodiment **10** in which a first electrical contact in the form of a flexible conductive helical member **21** and a second electrical contact in the form of ends of a plurality of conductive wires **23** are caused to engage when the display member and elongate member **20** are in the activate orientation **20**B. In this embodiment, the helical member **21** and a descending extender portion **25** thereof are part of the elongate member **20** which is attached at a first end **26** to a mounting member **27** for swingable movement of a second end **28**.

In the embodiment **10**, the elongate member **20** includes, proximate to its second end **28**, an air motion sensitive member in the form of a vane **29**. Thus, an external perturbation, e.g., air movement, moves the elongate mem-

ber **20** to complete an electrical circuit through the first and second electrical contacts **21, 22** to energize the transducer circuit **12**.

FIG. **2**A is a view similar to FIG. **1** illustrating another preferred embodiment **30**. In the embodiment **30**, an elongate member **40** has a first electrical contact in the form of a flexible helical member **21'**, a flexible cord **44** received therethrough and, proximate to its second end **28**, an acceleration sensitive member in the form of a weight or bob **46**. Thus the external perturbation of acceleration may move the elongate member **40**, relative to the display member **18'**, from a stable quiescent orientation **40**A to a unstable active orientation **40**B. This completes an electrical circuit through the first and second electrical contacts **21, 22**.

FIG. **2**B illustrates another preferred embodiment **50**. In the embodiment **50**, an elongate member **40'** has a first electrical contact in the form of a flexible helical member **21'** and a flexible cord **44'** received therethrough. A display member **18"** is swingably supported from a first end **26** of the elongate member. The second end **28** of the elongate member **40'** is suspended via a ring **51** to an external support **52**. Therefore, the external perturbation of acceleration may move the display member **18"**, relative to the elongate member **40'**, from a stable quiescent orientation **53**A to an unstable activate orientation **53**B. The stability of the orientation **53**A is maintained by forming the display member with a center of gravity lower than the elongate member first end **26**. This may be done, for example, by adding a weight **54** to the lower part of the display member **18"**.

In apparatus embodiments **10, 30** and **50**, the first and second electrical contacts **21, 22** are connected in series via a printed circuit, carried by the mounting member **27**, with the electrically responsive transducer circuit **12**. In embodiments **10** and **30**, the respective display member **18, 18'** is suspended from an external support member **52**. The wall **55** of the display member **50** defines an internal space **56** and an aperture **57** which is dimensioned to clear the elongate member.

In the embodiment **10**, the elongate member **20** has a vane **29** carried by an integral extender **20** and helical member **21**. In the embodiments **30** and **50**, and the elongate members comprise a helical member responsive to a flexible cord. It should be understood that these elongate member embodiments are exemplary. For example, in other embodiments of the invention an acceleration sensitive member could be combined with an integral extender and helical member while an air motion sensitive member could be combined with a helical member responsive to an elongate element received therethrough. Additionally, it should be understood that stiffer members (e.g. a wire) could be substituted for the cords **44, 44'** of the embodiments **30, 50**.

The transducer circuit **12** mounted within the display member includes sound and/or light and/or motion and/or heat transducers depending on the particular application. For example, for a wind chime application, the transducer circuit **12** would include a sound transducer or speaker. In a decorative display application, the output transducer could comprise one or more light sources, e.g., light emitting diodes, or a small motor to create various visual effects. In a still further application, the output transducer could comprise a heating element useful, for example, to dispense an aromatic vapor, i.e., perfume. When the light and/or motion transducers are used, at least the upper portion or the wall **55** (in FIG. **1**) is preferably formed of a transparent or translucent material (e.g. a polymer) to facilitate observation thereof.

It should be apparent from FIGS. **1, 2**A and **2**B that the embodiments **10, 30** and **50** are configured so that the respective stable quiscent orientations **20**A, **40**A and **53**A are gravity determined while the respective unstable activated orientations **20**B, **40**B and **53**B are determined by external perturbations. Embodiments of the invention are, therefore, suitable for initiating and presenting a display comprising sound and/or light and/or motion in any environment that provides air motion (e.g, a porch open to the wind, a fan), acceleration of the external support member **52** (e.g. the dashboard of an automobile) or other external perturbation.

Attention is now directed to additional details of FIGS. **1, 2**A and **2**B. In the embodiments **10, 30** and **50**, the helical members **21, 21'** are respectively received over insulating spools **60, 60'** attached to the mounting member **27**. Although the shape of the helical member **21, 21'** lend a natural resistance to metal fatigue induced by repeated movement of the elongate members **20, 40** and **40'** between the quiescent and active orientations, the members **21, 21'** are preferably formed of a soft metal to further enhance such resistance. The spool **60'** of FIGS. **2**A, **2**B defines a central tube to receive cords **44, 44'** which are knotted at **66** for retention by the spool **60'**.

As shown in FIG. **1**, the conductive wires **23** are carried by supports **62** descending from the mounting member **27**. The upper ends of the helical member **21** and wires **23** are soldered at **64** to the printed circuit of the mounting member **27**. The display member **18** defines an annular ledge **68** to retain the mounting member **27** thereto (the ledge **68** may be locally relieved for installation of the member **27**).

In the embodiment **10**, a plurality of flexible lines **70** terminating in an attachment member **71** (e.g. a loop, a hook) are externally secured radially to the wall **55** (e.g. knotted on the inner side thereof) for suspending the display member **18** from a projection **72** secured to the supporting member **52** (the line **70**A terminates above the upper wall **55** because of the sectional view of FIG. **1**). In the embodiment **30**, a spring **76** which may enhance the gravity response of the bob **46**, replaces the plurality of lines **70** with the aid of a restraining ball **77**. In the embodiment **50**, a ring **51** is used to suspend the elongate member second end **18** from the external support member **52**.

The supporting member **52** can form part of an immovable structure, e.g. a house beam, or alternatively, can comprise part of a movable structure such as an automobile roof The plurality of radially attached lines **70** facilitates vertical alignment of the housing **50** from the supporting member **52**.

FIG. **3** is a view along the plane **3**—**3** of FIG. **1** illustrating how the form of the helical member (first electrical contact) **21** facilitates radial spacing therefrom of the plurality of second electrical contacts **22**. When the helical member swings from the quiescent orientation **21** A to the activate orientation **21**B it will abut one or more second electrical contacts **22**.

Attention is now directed to FIG. **4**A which illustrates another preferred apparatus embodiment **80** having a display member **83** supporting a mounting member **86**. In the apparatus **80**, a plurality of elongate member **90** (similar to the elongate member **20** shown in FIG. **1**) each define a first electrical contact in the form of a helical member **89**. A plurality of second electrical connectors in the form of annular rings **93** line openings **97** defined by the display member **83**. Each of the elongate members **90** is attached at a first end **98** to the mounting member **86** for swingable

movement, relative to the display member **83**, of a second end **99** from a substantially vertical gravity determined quiescent orientation **90**A to an external perturbation driven activate orientation **90**B. This structure is further illustrated in FIG. **4**B which is a view along the plane **4**B—**4**B of FIG. **4**A.

The embodiment **80** provides structure, therefore, to activate the transducer circuit **12**, via any first electrical contact **89** and its associated second contact **93**, with a plurality of elongate members **90** each responsive to movement of air. Alternatively, the transducer circuit **12** may comprise a plurality of transducers each activated by a different first and second electrical contact pair.

FIG. **5** illustrates another preferred apparatus embodiment **110** having a display member **113** supporting a mounting member **116**. In the apparatus **110**, a conductive elongate member **120** (similar to the elongate member **20** shown in FIG. **1**) having a helical member **121** forms a first electrical contact. Another elongate member **130** having a helical member **131** forms a second electrical contact. The elongate members **120**, **130** are attached at a first end **132** to the mounting member **116** for swingable movement, relative to the display member **113**, of a second end **134** from, respectively, quiescent orientations **120**A, **130**A to external perturbation driven activate orientations **120**B, **130**B which complete an electrical path through the transducer circuit **12**. The embodiment **110** provides structure, therefore, to activate the transducer circuit **12** via contact between first and second electrical contacts formed by elongate members **120**, **130**.

Another apparatus embodiment **140** is shown in FIG. **6**. The embodiment **140** is similar to an inverted form of the embodiment **10** of FIG. **1**. The display member **142** is configured to rest on a base **144** and the elongate member **146** includes a vane **148** to respond to air movement so that the relative orientation of the members **142**, **146** changes from the quiescent orientation **150**A to the activate orientation **150**B.

Another apparatus embodiment **160** is illustrated in FIG. **7** which is similar to an inverted form of the embodiment **30** of FIG. **2**. The display member **162** is configured to rest on a base **164** and the elongate member **166** includes a bob **168** to respond to acceleration so that the relative orientation of the members **162**, **166** changes from the quiescent orientation **170**A to the active orientation **170**B.

Whereas the elongate members in the embodiments of FIGS. **1**, **2**A, **2**B, **4**A, **4**B and **5** could be flaccid, the elongate members of FIGS. **6** and **7** must be sufficiently stiff so as to be free standing. Thus, a suitable elongate member could be formed of a material having appropriate spring characteristics to inherently establish its stable vertical orientation or could be formed of a rigid material which is spring mounted in a manner to establish its stable vertical orientation. It is also pointed out that in both FIGS. **6** and **7**, the display members **142** and **162** are preferably secured to the base **144**, **164** by a suitable means such as an adhesive or by Velcro.

FIG. **8** depicts a circuit diagram of the transducer circuit **12** which includes a pattern generator **250**, a filter and amplifier **252** and a sound transducer **254**A. Alternatively, the circuit **12** may include a light transducer **254**B and/or a motion transducer **254**C and/or a heat transducer **254**D. The first and second electrical contacts **21**, **22** (shown for example in FIG. **1**) are connected in series with the transducer circuit **12**. When the elongate member and display member are in their activate orientation (e.g. member **18**, **20** of FIG. **1**) are in their quiescent orientation, the first and second electrical contacts **21**, **22** will be spaced from one another as shown in FIG. **8**. When they move to the activate orientation, the first and second electrical contacts **21**, **22** will move into electrical contact to energize the transducer circuit **12** by completing an electrical circuit through it (e.g. by connecting the voltage supply **256** to the remainder of the circuitry).

Various commercially available pattern generators are known for producing signals for driving the transducers **254** to produce desired outputs. For example, inexpensive semiconductor chips (presently used in greeting cards and toys) can be used as the pattern generator **200**. Such chips are readily capable of producing different electrical patterns for driving the transducers **254**. Each pattern can be activated when the circuit is completed through a different trigger input **260**.

When the sound transducer **254**A (e.g. a speaker) is used, the transducer circuit **12** may synthesize and emit various sounds which simulate chimes, wind, ocean waves, etc. These sounds may each be activated, for example, when the circuit is completed through a different one of the second electrical contacts **22**. The transducer circuit **12** is preferably provided with various control inputs **262** which enable a user to control, for example, melody, tempo, duration, etc. Similarly, the filter and amplifier **252** is preferably provided with one or more controls **264** for enabling the user to control volume and pitch.

In operation, for example with the apparatus **20** mounted as shown in FIG. **1**, an external perturbation will swing the elongate member **20** from the quiescent to the activate orientation to momentarily connect the first and second electrical contacts **21**, **22**. This momentary contact is sufficient to activate the pattern generator **250** to drive the sound transducer **254**A in accordance with information preprogrammed into the pattern generator **250**, as modified by the settings of the control **260**, **262**.

In contrast, for example, to a conventional wind chime apparatus in which the sound output depends upon the magnitude of the collision between elements, embodiments of the present invention can produce a sound output which is selectively related to or independent of the magnitude of the collision. As noted, the sound output depends upon the preprogramming of the pattern generator **250** as well as the controls **262**, **264**.

In a manner similar to that described above, the alternative light transducer **254**B can display patterns of light produced by miniature light sources, the alternative motion transducer **254**C can display motion produced by miniature electrical motors and the alternative heat transducer **254**D can dispense an aromatic vapor.

The transducers **254**, filter and amplifier **252** and pattern generator **250** can all be readily packaged on a small circuit board (e.g. printed circuit board defined by the mounting member **27** in FIG. **2**) which can be easily accommodated as indicated within the broken line **12** in FIGS. **1**, **2**, **4**, **5**, **6** and **7**.

FIG. **9** illustrates an alternate arrangement of the circuit diagram of FIG. **8** in which the circuit is completed by the first electrical contact **21** abutting pairs of second electrical contacts **22** as shown in the activate orientation **21**B.

Attention is now directed to FIG. **10** which illustrates another application. The apparatus embodiment **300** having a display member **310** supported by an elongate supporting member **311**. When acceleration of a motor vehicle initiates a motion switch as illustrated by FIG. **7**, electrical current

passes through the heater element **307** which is represented by **254**D of FIG. **8** and FIG. **9**. Heat energy generated by the heater element is conducted to the heat sink **308** which in turn warms up the heat sensitive air freshner aromatic material **309**. When the apparatus **300** is plugged into a cigarette lighter socket of a motor vehicle, contact members **301** and **303** conduct electrical current to the heater and motion sensor through conductor wires **305**, **306**. Contact member **301** locates at the end of the terminal end **312** and is supported by the spring **302**. Contact member **303** locates proximal by the side of the terminal end **312** and is spring loaded by the elastic portion **304**.

FIG. **11** is a sectional view of the preferred apparatus embodiment of FIG. **10**. The elongate member **311** comprises of two tubular stems **321** and **322**. Screw **324** engages into the recess **323** so as to lock the relative positions of the tubular stems **321**, **322** when the desirable length of the apparatus is adjusted.

FIG. **12** is an alternative embodiment to adjust the length of the elongate supporting member. The intermediate mounting bracket **336** connects the two segments of the tubular stems **334**, **335**. The screw threads **337**, **338** of the bracket are arranged in a way such that when the bracket **336** is rotated, the two stems **334** and **335** move in opposite directions. The guide pin **339** extended from the first tubular stem **335** is interconnected with the guiding slot **340** extended from the tubular stem **334** such that the two stems will not rotate with respect to each other.

Another application of the invention is a display apparatus in use with motor vehicle to produce lighting effects for the enhancement of driving pleasure at night. Because American cars provide battery power through the cigarette lighter all the time even when the car is turned off, it is desirable for the apparatus to be care free to the users such that the display apparatus turns on automatically only when the car is in motion and during night time. FIG. **13** illustrates circuit means to switch power to the apparatus only when a predetermined darkness level is detected by the light sensitive electrical component **363**. In day time, sufficient light current saturates the photo transistor **363** which in turn cuts off the transistors **361**, **366**. During night time, photo transistor **363** turns off and transistors **361** is turned on by current path along the resistors **364**, **365**. As a result, transistor **366** is turned on and electrical power is delivered to the terminal **362**.

In the application of wind chimes, it is desirable for the electrical power to be automatically turned on only in day time so that the wind chime is kept quiet during night time. An embodiment to achieve this desirable effect is illustrated in FIG. **14**. Photo transistor **363** saturated by light current turns on transistors **361**, **365** and power is supplied to terminal **362**. During night time, transistor **361** is cut off by the resistors **364**, **365** and accordingly transistor **366** switches off the power supplied to terminal **362**.

Various commercially available light sensitive electrical components are known for achieving the above mentioned desirable light dependent switching effects. For example, inexpensive photo resistor (Cds cells) and photo diodes which are responsive to different light spectrum can be used to design a switching circuit.

In order to reduce the current loading of the light dependent power switch, the switch output **362** can only be connected to a suitable portion of the circuit means such as the transducer portion or the pattern generator portion to inhibit the apparatus from working. Alternatively, the light sensitive electrical component can be readily interfaced with the control portion of the circuit mean so as to inhibit the circuit means from receiving a trigger signal under the undesirable lighting environment. FIG. **15** illustrate an alternative embodiment to achieve the desirable result. During day time, photo transistor **381** is turned on and the circuit means **386** is triggered when the first electrical contact **382** abutting pairs of second electrical contacts **383**, **384**. During night time, electrical contact **383** is in high impedance and the circuit means is not triggered even when the electrical contact **383**, **384** are conducted by the first electrical contact **382**.

When the position of the light sensitive electrical component is properly focused, it can be used for close distance motion detection, e.g. a trigger signal is generated when the light sensor of the apparatus is in motion or the overall light level of the optical image picked up is changed by a close by moving object. It should be understood that a single light sensitive electrical component can be used to detect close by motion and switch off the circuit means by night time.

The combination of a magnetic material such as permanent magnet or plastic molded magnet to the different display embodiments described provides a display magnet which triggers the playback of sound, such as a prerecorded audio message defined by the pattern generator; or various kinds of lighting effects when the refrigerator door is opened or closed.

From the foregoing, it should be appreciated that transducer apparatus embodiments have been disclosed herein energizeable in response to external perturbations such as wind, acceleration or motion.

The preferred embodiments of the invention described herein are exemplary and numerous modifications, dimensional variations and rearrangements can be readily envisioned to achieve an equivalent result, all of which are intended to be embraced within the scope of the appended claims.

What is claimed is:

1. An apparatus dimensioned to plug into the cigarette lighter socket of a vehicle comprising:

a terminal end including a first electrical contact member;

at least one second electrical contact member locates proximal to said terminal end;

a housing member remote from said terminal end; and

a variable length elongate supporting member comprising rotational means extending along an axis originated from said terminal end and mounted from said terminal end to said housing member for rotatably adjusting the distance therebetween.

2. The apparatus of claim **1** further comprising a heat transducer to conduct electrical current from said electrical contact members.

3. The apparatus of claim **1** further comprising a light transducer to conduct electrical current from said electrical contact members.

4. The apparatus of claim **1** wherein the cross sectional area of said variable length elongate supporting member is smaller than the corresponding cross sectional area of said housing member.

5. The apparatus of claim **1** further comprising circuit means to conduct electrical current from said contact member.

6. The apparatus of claim **5** further comprising an electrically responsive transducer to be energized by said circuit means.

7. The apparatus of claim **6** further comprising a light sensitive electrical component for controlling the activation of said transducer.

8. The apparatus of claim 6 further comprising:

a motion sensor including a first sensor member and a second sensor member wherein said circuit means responsive to the relative movement of the first sensor member with respect to the second sensor member, for energizing said transducer.

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